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10/802,675	03/17/2004	Osamu Shinkawa	9319A-000735	2688

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EXAMINER
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UHLLENHAK, JASON S

ART UNIT	PAPER NUMBER
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2853

DATE MAILED: 03/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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<b>Office Action Summary</b>	<b>Application No.</b> 10/802,675	<b>Applicant(s)</b> SHINKAWA, OSAMU	
	<b>Examiner</b> Jason Uhlenhake	<b>Art Unit</b> 2853	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |                                                                                                    |                                                                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. ____                                                 |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>10/14/04; 3/17/04</u> .                                                   | 6) <input type="checkbox"/> Other: ____                                     |

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 8, 15, 16, 18, 19 are rejected under 35 U.S.C. 103(a) as being obvious over Hirano (U.S. Pat. 5,731,826) in view of Sakagami et al (U.S. Pub. 2005/0122360) and Watanabe (U.S. Pat. 4,484,199).

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing

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that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

***Hirano discloses:***

- ***regarding claim 1***, droplet ejection apparatus having a driving circuit (54) (Column 19, Lines 3 – 7; 21 – 30) and a plurality of droplet ejection heads (Column 5, Lines 33 – 37)
  - cavity (323d) filled with liquid; nozzle (323c) communicated with the cavity through which the liquid is ejected in the form of droplets in response to the increase and decrease of the internal pressure of the cavity (Figures 6, 16A, 16B)
- ***regarding claim 1 and claim 16***, judging means for judging whether or not an ejection failure is occurring in the droplet ejection head (Column 3, Lines 20 – 30; Column 7, Lines 32 – 40)

***Hirano does not disclose expressly:***

- ***regarding claim 1***, an actuator driven by the driving circuit and a diaphragm displaced by the actuator
  - oscillation means which generates a signal on the basis of a residual vibration of the diaphragm displaced by the actuator after driving the actuator by the driving circuit
  - subtracting means which subtracts the number of pulses, which are included in the signal generated by the oscillation means for a predetermined time period, from a predetermined reference value

- **regarding claim 8**, the oscillation means includes a resistance component connected to the actuator, and forms a CR oscillation circuit based on the electric capacitance component of the actuator and a resistance component of the resistor element
- **regarding claim 15**, the predetermined reference value is the number of pulses in the signal generated by the oscillation means for the predetermined time period when the droplet is normally ejected from the droplet ejection head
- **regarding claim 16**, obtaining a subtraction result by the subtracting means when the oscillation means generates the signal by scanning each of the plurality of droplet ejection heads.
- **regarding claim 18**, the actuator includes a piezoelectric actuator having a piezoelectric element and using a piezoelectric effect of the piezoelectric element
- **regarding claim 19**, the droplet ejection apparatus includes an ink jet printer

***Sakagami et al discloses:***

- **regarding claim 1**, oscillation means which generates a signal on the basis of a residual vibration of the diaphragm displaced by the actuator after driving the actuator by the driving circuit (Paragraph 0024), for the purpose of detecting ejection failure.
- **regarding claim 1**, an actuator driven by the driving circuit and a diaphragm displaced by the actuator (Paragraph 0022), for the purpose of printing with more stability and reliability.

- **regarding claim 8**, the oscillation means includes a resistance component connected to the actuator, and forms a CR oscillation circuit based on the electric capacitance component of the actuator and a resistance component of the resistor element (Paragraph 0024), for the purpose of detecting ejection failure of the apparatus.

- **regarding claim 18**, the actuator includes a piezoelectric actuator having a piezoelectric element and using a piezoelectric effect of the piezoelectric element (Paragraphs 0029), for the purpose of printing with more stability and reliability.

- **regarding claim 19**, the droplet ejection apparatus includes an ink jet printer (Paragraph 0029), for the purpose of performing the operation of the droplet ejection apparatus.

**Watanabe discloses:**

- **regarding claim 1, and claim 16**, subtracting means which subtracts the number of pulses, which are included in the signal generated by the oscillation means for a predetermined time period, form a predetermined reference value (Column 3, Lines 65 – 67; Column 4, Lines 1 – 8), for the purpose of detecting ejection failure.

- **regarding claim 15**, the predetermined reference value is the number of pulses in the signal generated by the oscillation means for the predetermined time period when the droplet is normally ejected from the droplet ejection head value (Column 3, Lines 65 – 67; Column 4, Lines 1 – 8), for the purpose of detecting ejection failure.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of an actuator driven by the driving circuit and a diaphragm displaced by the actuator; oscillation means which generates a signal on the basis of a residual vibration of the diaphragm displaced by the actuator after driving the actuator by the driving circuit; subtracting means which subtracts the number of pulses, which are included in the signal generated by the oscillation means for a predetermined time period, from a predetermined reference value; the oscillation means includes a resistance component connected to the actuator, and forms a CR oscillation circuit based on the electric capacitance component of the actuator and a resistance component of the resistor element; the actuator includes a piezoelectric actuator having a piezoelectric element and using a piezoelectric effect of the piezoelectric element; the droplet ejection apparatus includes an ink jet printer; the predetermined reference value is the number of pulses in the signal generated by the oscillation means for the predetermined time period when the droplet is normally ejected from the droplet ejection head value as taught by Sakagami et al, and Watanabe into the device of Hirano. The motivation for doing so would have been to print with more stability and reliability and to detect ejection failure and performing the operation of the droplet ejection apparatus.

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano (U.S. Pat. 5,731,826) as modified by Sakagami et al (U.S. Pub. 2005/0122360) and

Watanabe (U.S. Pat. 4,484,199), as applied to claim 1 above, and further in view of Ishinaga et al (U.S. Pub. 2002/0149657).

***Hirano as modified by Sakagami et al, and Watanabe discloses all the claimed limitations except for the following:***

- ***regarding claim 2***, wherein the judging means judges a cause of the ejection failure when it is judged that the ejection failure is occurring

***Ishinaga et al discloses:***

- ***regarding claim 2***, wherein the judging means judges a cause of the ejection failure when it is judged that the ejection failure is occurring (Paragraphs 201 – 203), for the purpose of maintaining a quality print image.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of the judging means judges a cause of the ejection failure when it is judged that the ejection failure is occurring as taught by Ishinaga et al into the device of Hirano as modified by Sakagami et al, and Watanabe. The motivation for doing so would have been to maintain the quality of print image.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano (U.S. Pat. 5,731,826) as modified by Sakagami et al (U.S. Pub. 2005/0122360) and Watanabe (U.S. Pat. 4,484,199), as applied to claim 1 above, and further in view of Kawamura (U.S. Pat. 4,577,203)

***Hirano as modified by Sakagami et al, and Watanabe discloses:***



- **regarding claim 3**, subtracting means which subtracts the number of pulses (Column 3, Lines 65 – 67; Column 4, Lines 1 – 8).

***Hirano as modified by Sakagami et al, and Watanabe discloses all the claimed limitations except for the following:***

- **regarding claim 3**, the judging means judges that an air bubble has intruded into the cavity in the case where the result is smaller than a first threshold

***Kawamura discloses:***

- **regarding claim 3**, the judging means judges that an air bubble has intruded into the cavity in the case where the result is smaller than a first threshold (Column 3, Lines 53 – 67; Column 4, Lines 1 – 8), for the purpose of overcoming the problems caused by air bubbles in the ink and clogging of the ink passages.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of the judging means judges that an air bubble has intruded into the cavity in the case where the result is smaller than a first threshold as taught by Kawamura into the device of Hirano as modified by Sakagami et al, and Watanabe. The motivation for doing so would have been to overcome the problems caused by air bubbles in the ink and clogging of the ink passages.

Claims 4, 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano (U.S. Pat. 5,731,826) as modified by Sakagami et al (U.S. Pub. 2005/0122360) and Watanabe (U.S. Pat. 4,484,199), as applied to claim 1 above, and further in view of Noyes et al (U.S. Pat. 6,364,452)

***Hirano as modified by Sakagami et al, and Watanabe discloses***

- ***regarding claim 5***, judges that paper dust is adhering in the vicinity of the outlet of the nozzle in the case where result is smaller than the second threshold and larger than a third threshold (Sakagami et al: Paragraph 0023)

- ***regarding claims 4 and 5***, subtracting means which subtracts the number of pulses (Watanabe: Column 3, Lines 65 – 67; Column 4, Lines 1 – 8)

***Hirano as modified by Sakagami et al, and Watanabe does not disclose expressly:***

- ***regarding claim 4***, judging means judges the liquid in the vicinity of the nozzle has thickened due to drying in the case where result is larger than a second threshold

***Noyes et al discloses:***

- ***regarding claim 4***, judging means judges the liquid in the vicinity of the nozzle has thickened due to drying in the case where result is larger than a second threshold (Column 80, Lines 12 – 23), for the purpose of removing blockage to maintain a high print quality.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of judging means judges the liquid in the vicinity of the nozzle has thickened due to drying in the case where result is larger than a second threshold as taught by Noyes et al into the device of Hirano as modified by Sakagami et al, and Watanabe. The motivation for doing so would have been to remove any blockage to maintain a high print quality.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano (U.S. Pat. 5,731,826) as modified by Sakagami et al (U.S. Pub. 2005/0122360) and Watanabe (U.S. Pat. 4,484,199), as applied to claim 1 above, and further in view of Kono et al (U.S. Pat. 6,322,190)

***Hirano as modified by Sakagami et al, and Watanabe discloses all the claimed limitations except for the following:***

- ***regarding claim 6***, storage means for storing the cause of the ejection failure judged by the judging means

***Kono et al discloses:***

- ***regarding claim 6***, storage means for storing the cause of the ejection failure judged by the judging means (Column 2, Lines 24 – 31; Column 4, Lines 49 – 52; Column 5, Lines 5 – 11), for the purpose of detecting ejection failure.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of storage means for storing the cause of the ejection failure judged by the judging means as taught by Kono et al into the device of Hirano as modified by Sakagami et al, and Watanabe. The motivation for doing so would have been to detect ejection failure.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano (U.S. Pat. 5,731,826) as modified by Sakagami et al (U.S. Pub. 2005/0122360) and

Watanabe (U.S. Pat. 4,484,199), as applied to claim 1 above, and further in view of Sakagami et al (U.S. Pub. 2004/023914)

***Hirano as modified by, Sakagami et al, and Watanabe discloses all the claimed limitations except for the following:***

- ***regarding claim 7***, switching means for switching a connection of the actuator from the driving circuit to the oscillation means after carrying out a droplet ejection operation by driving the actuator

***Sakagami et al ('714) discloses:***

- ***regarding claim 7***, switching means for switching a connection of the actuator from the driving circuit to the oscillation means after carrying out a droplet ejection operation by driving the actuator (Paragraph 0173), for the purpose of detecting an ejection failure.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of switching means for switching a connection of the actuator from the driving circuit to the oscillation means after carrying out a droplet ejection operation by driving the actuator as taught by Sakagami et al ('714) into the device of Hirano as modified by Sakagami et al, and Watanabe. The motivation for doing so would have been to detect an ejection failure.

Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano (U.S. Pat. 5,731,826) as modified by Sakagami et al (U.S. Pub. 2005/0122360)

and Watanabe (U.S. Pat. 4,484,199), as applied to claim 1 above, and further in view of Fujii et al (U.S. Pub. 2001/0007460)

***Hirano as modified by Sakagami et al, and Watanabe discloses all the claimed limitations except for the following:***

- ***regarding claim 9***, predetermined time period includes one or more time period in the residual vibration of the diaphragm when the droplet is normally ejected from the droplet ejection head
- ***regarding claim 10***, predetermined time period is a time period until the residual vibration is generated after the droplet has been normally ejected from the droplet ejection head

***Fujii et al discloses:***

- ***regarding claim 9***, predetermined time period includes one or more time period in the residual vibration of the diaphragm when the droplet is normally ejected from the droplet ejection head (Figure 8; Paragraph 01017), for the purpose of reducing printing trouble caused by a failure of abnormality in ink ejections.
- ***regarding claim 10***, predetermined time period is a time period until the residual vibration is generated after the droplet has been normally ejected from the droplet ejection head (Figure 8; Paragraph 0107), for the purpose of reducing printing trouble caused by a failure of abnormality in ink ejections.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of predetermined time period includes one or more time period in the residual vibration of the diaphragm when the droplet is

normally ejected from the droplet ejection head; predetermined time period is a time period until the residual vibration is generated after the droplet has been normally ejected from the droplet ejection head as taught by Fujii et al into the device of Hirano as modified by Sakagami et al, and Watanabe. The motivation for doing so would have been to reduce print trouble caused by a failure of abnormality in ink ejections.

Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano (U.S. Pat. 5,731,826) as modified by Sakagami et al (U.S. Pub. 2005/0122360), Watanabe (U.S. Pat. 4,484,199) and Fujii et al (U.S. Pub. 2001/0007460), as applied to claim 1 above, and further in view of Shingyohuchi (U.S. Pat. 6,811,238)

***Hirano as modified by Sakagami et al, Watanabe and Fujii et al discloses all the claimed limitations except for the following:***

- ***regarding claim 11***, predetermined time period is a time period until a half cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head
- ***regarding claim 12***, predetermined time period includes time periods every half cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head

***Shingyohuchi discloses:***

- ***regarding claim 11***, predetermined time period is a time period until a half cycle of the residual vibration of the diaphragm after the droplet has been normally

ejected from the droplet ejection head (Claim 43), for the purpose of enabling fine droplets to be ejected.

- ***regarding claim 12***, predetermined time period includes time periods every half cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head (Claim 43), for the purpose of enabling fine droplets to be ejected.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of predetermined time period is a time period until a half cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head; predetermined time period includes time periods every half cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head as taught by Shingyohuchi into the device of Hirano as modified by Sakagami et al, Watanabe and Fujii et al. The motivation for doing so would have been to enable fine droplets to be ejected.

Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano (U.S. Pat. 5,731,826) as modified by Sakagami et al (U.S. Pub. 2005/0122360), Watanabe (U.S. Pat. 4,484,199) and Fujii et al (U.S. Pub. 2001/0007460), as applied to claim 1 above, and further in view of Shingyohuchi (U.S. Pub. 2002/0036667)

***Hirano as modified by, Sakagami et al, Watanabe and Fujii et al discloses all the claimed limitations except for the following:***

- ***regarding claim 13***, predetermined time period is a time period until a quarter cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head
- ***regarding claim 14***, predetermined time period includes time periods of every quarter cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head

***Shingyohuchi discloses:***

- ***regarding claim 13***, predetermined time period is a time period until a quarter cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head (Paragraph 0175), for the purpose of providing an ink jet head that enable fine droplets to be ejected.
- ***regarding claim 14***, predetermined time period includes time periods of every quarter cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head (Paragraph 0175), for the purpose of providing an ink jet head that enable fine droplets to be ejected.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of predetermined time period is a time period until a quarter cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head; predetermined time period includes time periods of every quarter cycle of the residual vibration of the diaphragm



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after the droplet has been normally ejected from the droplet ejection head as taught by Shingyohuchi into the device of Hirano as modified by Sakagami et al, Watanabe and Fujii et al. The motivation would have been to provide an ink jet head that enables fine droplets to be ejected.

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano (U.S. Pat. 5,731,826) as modified by Sakagami et al (U.S. Pub. 2005/0122360) and Watanabe (U.S. Pat. 4,484,199), as applied to claim 1 above, and further in view of Nojima et al (U.S. Pat. 6,168,263)

***Hirano as modified by Sakagami et al, and Watanabe discloses all the claimed limitations except for the following:***

- ***regarding claim 17***, the actuator includes an electrostatic actuator

***Nojima et al discloses:***

- ***regarding claim 17***, the actuator includes an electrostatic actuator (111) (Column 1, Lines 15 – 20), for the purpose of generating pressure to eject ink droplets.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of the actuator includes an electrostatic actuator as taught by Nojima et al into the device of Hirano as modified by Sakagami et al, and Watanabe. The motivation for doing so would have been to generate pressure to eject ink droplets.

Claims 20, 26 are rejected under 35 U.S.C. 103(a) as being obvious over Hirano (U.S. Pat. 5,731,826) in view of Sakagami et al (U.S. Pub. 2005/0122360) and Watanabe (U.S. Pat. 4,484,199).

***Hirano discloses:***

- ***regarding claim 20***, method of judging whether or not an ejection failure is occurring in the droplet ejection heads (Column 3, Lines 20 – 30; Column 7, Lines 32 – 40)

***Hirano does not disclose expressly:***

- ***regarding claim 20***, generating a signal with an oscillation circuit on basis of a residual vibration of the diaphragm after carrying out an operation in which a liquid within the cavity is ejected through the nozzle in the form of droplets by driving the actuator with a driving circuit and displacing the diaphragm

- subtracting the number of pulses, of which the signal generated by oscillation means is generated for a predetermined time period, from a predetermined reference value

- ***regarding claim 26***, predetermined reference value is the number of pulses, which are included in the generated signal for the predetermined time period when the droplet is normally ejected from the droplet ejection head

***Sakagami et al discloses:***

- ***regarding claim 1***, generating a signal with an oscillation circuit on basis of a residual vibration of the diaphragm after carrying out an operation in which a liquid

within the cavity is ejected through the nozzle in the form of droplets (Paragraph 0024), for the purpose of detecting ejection failure.

- **regarding claim 20**, an actuator driven by the driving circuit and a diaphragm displaced by the actuator (Paragraph 0022), for the purpose of printing with more stability and reliability.

***Watanabe discloses:***

- **regarding claim 1**, subtracts the number of pulses, which are included in the signal generated by the oscillation means for a predetermined time period, from a predetermined reference value (Column 3, Lines 65 – 67; Column 4, Lines 1 – 8), for the purpose of detecting ejection failure.

- **regarding claim 26**, predetermined reference value is the number of pulses, which are included in the generated signal for the predetermined time period when the droplet is normally ejected from the droplet ejection head (Column 3, Lines 65 – 67; Column 4, Lines 1 – 8), for the purpose of detecting ejection failure.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of generating a signal with an oscillation circuit on basis of a residual vibration of the diaphragm after carrying out an operation in which a liquid within the cavity is ejected through the nozzle in the form of droplets by driving the actuator with a driving circuit and displacing the diaphragm; subtracting the number of pulses, of which the signal generated by oscillation means is generated for a predetermined time period, from a predetermined reference value; predetermined reference value is the number of pulses, which are included in the

generated signal for the predetermined time period when the droplet is normally ejected from the droplet ejection head as taught by Sakagami et al, and Watanabe into the device of Hirano. The motivation for doing so would have been to print with more stability and reliability, and detecting ejection failure.

Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano (U.S. Pat. 5,731,826) as modified by Sakagami et al (U.S. Pub. 2005/0122360) and Watanabe (U.S. Pat. 4,484,199), as applied to claim 1 above, and further in view of Ishinaga et al (U.S. Pub. 2002/0149657).

***Hirano as modified by Sakagami et al, and Watanabe discloses all the claimed limitations except for the following:***

- ***regarding claim 21***, judging means judges a cause of the ejection failure when it is judged that the ejection failure is occurring

***Ishinaga et al discloses:***

- ***regarding claim 21***, judging means judges a cause of the ejection failure when it is judged that the ejection failure is occurring (Paragraphs 201 – 203), for the purpose of maintaining a quality print image.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of the judging means judges a cause of the ejection failure when it is judged that the ejection failure is occurring as taught by Ishinaga et al into the device of Hirano as modified by Sakagami et al, and Watanabe. The motivation for doing so would have been to maintain the quality of print image.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano (U.S. Pat. 5,731,826) as modified by Sakagami et al (U.S. Pub. 2005/0122360), Watanabe (U.S. Pat. 4,484,199) and Ishinaga et al (U.S. Pub. 2002/0149657), as applied to claim 1 above, and further in view of Kawamura (U.S. Pat. 4,577,203)

***Hirano as modified by Sakagami et al, Watanabe, and Ishinaga et al discloses:***

- ***regarding claim 22***, subtracting means which subtracts the number of pulses (Column 3, Lines 65 – 67; Column 4, Lines 1 – 8)
- judges that paper dust is adhering in the vicinity of the outlet of the nozzle in the case where result is smaller than the second threshold and larger than a third threshold (Sakagami et al: Paragraph 0023)

***Hirano as modified by Sakagami et al, Watanabe, and Ishinaga et al does not disclose expressly:***

- ***regarding claim 22***, the judging means judges that an air bubble has intruded into the cavity in the case where the result is smaller than a first threshold
- judging means judges the liquid in the vicinity of the nozzle has thickened due to drying in the case where result is larger than a second threshold

***Kawamura discloses:***

- ***regarding claim 22***, the judging means judges that an air bubble has intruded into the cavity in the case where the result is smaller than a first threshold (Column 3,

Lines 53 – 67; Column 4, Lines 1 – 8), for the purpose of overcoming the problems caused by air bubbles in the ink and clogging of the ink passages.

***Noyes et al discloses:***

- ***regarding claim 22***, judging means judges the liquid in the vicinity of the nozzle has thickened due to drying in the case where result is larger than a second threshold (Column 80, Lines 12 – 23), for the purpose of removing blockage to maintain a high print quality.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of the judging means judges that an air bubble has intruded into the cavity in the case where the result is smaller than a first threshold; judging means judges the liquid in the vicinity of the nozzle has thickened due to drying in the case where result is larger than a second threshold as taught by Kawamura and Noyes et al into the device of Hirano as modified by Sakagami et al, Watanabe, and Ishinaga et al. The motivation for doing so would have been to overcome the problems caused by air bubbles in the ink and clogging of the ink passages, and to maintain a high print quality.

Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano (U.S. Pat. 5,731,826) as modified by Sakagami et al (U.S. Pub. 2005/0122360), Watanabe (U.S. Pat. 4,484,199) and Ishinaga et al (U.S. Pub. 2002/0149657), as applied to claim 1 above, and further in view of Kono et al (U.S. Pat. 6,322,190)

***Hirano as modified by Sakagami et al, Watanabe, and Ishinaga et al  
discloses all the claimed limitations except for the following:***

- ***regarding claim 23***, storage means for storing the cause of the ejection failure judged by the judging means

***Kono et al discloses:***

- ***regarding claim 23***, storage means for storing the cause of the ejection failure judged by the judging means (Column 2, Lines 24 – 31; Column 4, Lines 49 – 52; Column 5, Lines 5 – 11), for the purpose of detecting ejection failure.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of storage means for storing the cause of the ejection failure judged by the judging means as taught by Kono et al into the device of Hirano as modified by Sakagami et al, Watanabe and Ishinaga et al. The motivation for doing so would have been to detect ejection failure.

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano (U.S. Pat. 5,731,826) as modified by Sakagami et al (U.S. Pub. 2005/0122360), Watanabe (U.S. Pat. 4,484,199) and Ishinaga et al (U.S. Pub. 2002/0149657), as applied to claim 1 above, and further in view of Sakagami et al (U.S. Pub. 2004/023914)

***Hirano as modified by, Sakagami et al, Watanabe, and Ishinaga et al  
discloses all the claimed limitations except for the following:***

- **regarding claim 24**, switching means for switching a connection of the actuator from the driving circuit to the oscillation means after carrying out a droplet ejection operation by driving the actuator

***Sakagami et al ('714) discloses:***

- **regarding claim 24**, switching means for switching a connection of the actuator from the driving circuit to the oscillation means after carrying out a droplet ejection operation by driving the actuator (Paragraph 0173), for the purpose of detecting an ejection failure.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of switching means for switching a connection of the actuator from the driving circuit to the oscillation means after carrying out a droplet ejection operation by driving the actuator as taught by Sakagami et al ('714) into the device of Hirano as modified by Sakagami et al, Watanabe, and Ishinaga et al. The motivation for doing so would have been to detect an ejection failure.

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano (U.S. Pat. 5,731,826) as modified by Sakagami et al (U.S. Pub. 2005/0122360) and Watanabe (U.S. Pat. 4,484,199), as applied to claim 1 above, and further in view of Fujii et al (U.S. Pub. 2001/0007460), Shingyohuchi (U.S. Pat. 6,811,238), and Shingyohuchi (U.S. Pub. 2002/0036667)

***Hirano as modified by Sakagami et al, and Watanabe discloses all the claimed limitations except for the following:***



- **regarding claim 25**, predetermined time period includes one or more time period in the residual vibration of the diaphragm when the droplet is normally ejected from the droplet ejection head; predetermined time period is a time period until the residual vibration is generated after the droplet has been normally ejected from the droplet ejection head; predetermined time period is a time period until a half cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head; predetermined time period includes time periods every half cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head; predetermined time period is a time period until a quarter cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head; predetermined time period includes time periods of every quarter cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head

***Fujii et al discloses:***

- **regarding claim 25**, predetermined time period includes one or more time period in the residual vibration of the diaphragm when the droplet is normally ejected from the droplet ejection head (Figure 8; Paragraph 01017); predetermined time period is a time period until the residual vibration is generated after the droplet has been normally ejected from the droplet ejection head (Figure 8; Paragraph 0107), for the purpose of reducing printing trouble caused by a failure of abnormality in ink ejections.

***Shingyohuchi ('238) discloses:***

- **regarding claim 25**, predetermined time period is a time period until a half cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head (Claim 43); predetermined time period includes time periods every half cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head (Claim 43), for the purpose of enabling fine droplets to be ejected.

***Shingyohuchi ('667) discloses:***

- **regarding claim 25**, predetermined time period is a time period until a quarter cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head (Paragraph 0175); predetermined time period includes time periods of every quarter cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head (Paragraph 0175), for the purpose of providing an ink jet head that enable fine droplets to be ejected.

At the time the invention was made it would have been obvious to a person of ordinary skill in the art to incorporate the teaching of predetermined time period includes one or more time period in the residual vibration of the diaphragm when the droplet is normally ejected from the droplet ejection head; predetermined time period is a time period until the residual vibration is generated after the droplet has been normally ejected from the droplet ejection head; predetermined time period is a time period until a half cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head; predetermined time period includes time periods

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every half cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head; predetermined time period is a time period until a quarter cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head; predetermined time period includes time periods of every quarter cycle of the residual vibration of the diaphragm after the droplet has been normally ejected from the droplet ejection head as taught by Fujii et al, Shingyohuchi (238), and Shingyohuchi (667) into the device of Hirano as modified by, Sakagami et al, Watanabe, and Ishinaga et al. The motivation for doing so would have been to reduce printing trouble caused by a failure of abnormality in ink ejections, and enabling fine droplets to be ejected.

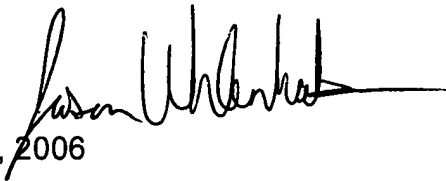
**Conclusion**

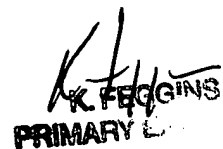
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason Uhlenhake whose telephone number is (571) 272-5916. The examiner can normally be reached on Monday - Friday 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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JSU  
February 28, 2006



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